

REMARKS/ARGUMENTS

Reconsideration is respectfully requested of the Final Office Action of December 31, 2009, relating to the above-identified application.

The claims in the case are: Claims 21, 24-26, 27, 29-34, 36, 38 to 40, and 42 to 52.

New claims 42 to 52 are directed to the subject matter described in the published application at [0002-0003], [0026, 0028, 0029, 0052, 0054] and in Examples 1-3. These sections of the application refer to the obtaining of a sol with improved stability by elimination of the alcohol found in the hydrolysis reaction and replacement thereof with the aprotic solvent. No new matter is present.

Claims 21, 24, 26, 27, 29-34, 36 and 38-39 stand rejected under 35 U.S.C. § 103(a) as unpatentable in view of *Kim* and *Minami*. Applicants traverse the rejection and request reconsideration.

The *Kim* article, "Surface Modified SiO₂ Xerogel Films from HMDS/Acetone for Intermetal Dielectrics", discloses a process for the production of porous SiO₂ xerogel films from a sol-gel process. In the prior known methods, it was very difficult to avoid shrinkage by capillary forces during the drying of the film. As a result, cracking and collapse of the three-dimensional structure formed in the aging process could occur. The solution proposed by *Kim* is the use of HMDS as a surface modifier in the process combined with acetone as a solvent without solvent exchange for the preparation of SiO₂ xerogel thin films.

The SiO₂ sol shown as being used by *Kim* was prepared using the known two-step acid/base catalyzed procedure of hydrolysis and condensation with tetraethoxysilane (TEOS) as a precursor and acetone as a solvent. The HMDS was used as a modifying agent.

The resulting sol is reported as being transparent. The gelation step was accomplished in seven hours at room temperature. Following that, in a stable range of viscosity the sol was spun on a p-type Si (100) substrate. The wet gel films which are spun on the substrate are then aged in acetone for 24 hours at room temperature. As an essential step in the *Kim* process, the wet-gel films were modified with HMDS in acetone without a solvent exchange step.

It is to be noted that the *Kim* article does not disclose or suggest the step of removing alcohol that is formed during the hydrolysis reaction and replacing it with the aprotic solvent and thereby forming a sol in the presence of the aprotic solvent. Claim 42 has been amended to make the distinction regarding the solvent exchange more clear. Basis is found in the above listed sections of the application, especially [0065].

Kim fails to disclose this step which is important to applicants' invention and, therefore, *Kim* does not suggest that any additional steps are needed to obtain a satisfactory result. In the absence of applicants' disclosure, there is nothing in *Kim* that would lead a person skilled in the art to the claimed invention.

The *Minami* published application, US 2002/0160153 A1, does not provide this missing feature. *Minami* describes a method for producing an article having a predetermined surface pattern. The steps carried out by *Minami* involve disposing a sol-gel material between a patterning die and a substrate in the form of a film and heating to coat the surface of the substrate with a gel film having a surface pattern. The surface pattern is the inverse of the surface pattern of the patterning die. The sol-gel material contains at least one compound selected from the silanes having the formula R^1SiX and at least one compound selected from the group consisting of the silane compound R^2SiY_3 wherein R^2 is an aryl group or a substituted aryl group, Y is an

alkoxy group or a halogen atom. According to paragraph [0034] of *Minami*, dilution solvents can be used including alcohols. However, *Minami* does not describe the importance of removal of the ethanol which is produced by the hydrolyzation of the alkoxides and replacing it with the aprotic solvent.

The key point in applicants' sol formulation process is the choice of the solvent. In applicants' work it has been found that the choice of an aprotic solvent such as acetone greatly increases the stability of the solution. In fact applicants' sol formulation with acetone is stable for at least several months whereas the same formulation with ethanol would be stable only for a few days. This is clearly a difference with respect to the *Minami* document in which a wide range of solvents are mentioned but in which an alcohol is cited as the solvent for the preferred formulation.

Minami teaches that the ethanol, some of which was actually added previously, is evaporated to concentrate the sol so as to obtain a higher viscosity and higher silica content. This is done to obtain a thicker film which is necessary for the subsequent embossing and to reduce shrinkage during drying which otherwise would lead to cracks in such a thick film. In the present invention, no ethanol is added and if the ethanol produced from the hydrolysis of the silane is evaporated, it must be replaced with an equal amount of aprotic solvent so that the concentration of the sol does not change. This is clearly pointed out in all of applicants' claims. The replacement of the extracted ethanol with equal amount of aprotic solvent increases the minimum shelf life of the solution from a few months to well over a year. If no aprotic solvent is added in replacement of the ethanol extracted, the concentration of the sol would increase and the stability of the sol would actually decrease. In the present invention, the evaporation is

therefore done with a different procedure (with subsequent addition of equal amount of aprotic solvent), for a different purpose (to increase the stability of the solution and not to reduce shrinkage in drying) and with a different final result (to further increase the shelf life of the solution and not to reduce cracking during drying).

The final results and objectives of the present invention are also very different from those of *Minami*. In the *Minami* patent the objective is to obtain a very thick film of several tens of microns that can be embossed and for this reason special care must be taken to avoid cracks during drying. The result of the present invention is a much thinner general purpose protecting coating film of optical quality that does not have particular problems with cracking due to the thinness but that greatly benefits on the industrial prospective of the increased shelf life of the sol (coating solution) that is achieved from the choice of solvent and eventually the ethanol extraction procedure.

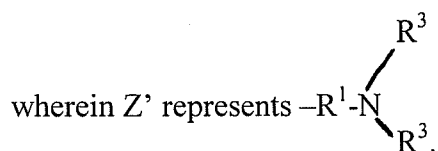
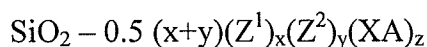
There is no suggestion in *Minami* that the process described by *Kim* could be improved in any way by the modifications shown by *Minami*. And indeed since *Minami* does not teach the replacement of ethanol with the aprotic solvent, the combination of *Kim* and *Minami* does not reach the present invention. Applicants respectfully submit that the combination of *Kim* and *Minami* does not create *prima facie* obviousness of the claimed invention and, therefore, the rejection should be withdrawn.

Applicants submit that new claims 42 to 52 are patentable over the cited references for the same reasons as set forth above.

Claim 40 stands rejected under 35 U.S.C. § 103(a) as unpatentable over *Kim* taken with *Minami* and *Ravaine, et al.*, US 4,923,950. Applicants traverse the rejection and request

reconsideration. The *Kim* and *Minami* references have already been discussed and the above remarks apply here as well.

Ravaine, US 4,923,950, describes a composition comprising a silica derivative modified by organic groups, said derivatives being an amorphous solid having the formula:



This composition is prepared by subjecting a mixture of $\text{Si}(\text{O-Alk})_4$, $\text{Si}(\text{O-Alk})_3\text{Z}^1$ and $\text{Si}(\text{O-Alk})_3\text{Z}^2$ to a hydrolysis and polycondensation reaction and wherein the water of said solution is of a quantity sufficient to hydrolyze the alkoxy silane groups of the said compounds of the mixture into corresponding silano groups and after completion of the reaction, heating the resulting gel to a constant weight at a temperature greater than 100°C but lower than the decomposition temperature of the material obtained.

Ravaine does not describe the hydrolyzation of the alkoxide solution in an aprotic solvent, followed by the removal of the alcohol by product.


It is therefore apparent that the cited references fail to point out the importance of the alcohol removal step and replacement of the alcohol with the aprotic solvent. Consequently, the combination of references fails to establish *prima facie* obviousness of the claimed subject matter.

Withdrawal of the rejection is requested.

Favorable action at the Examiner's earliest convenience is respectfully requested.

Respectfully submitted,

SMITH, GAMBRELL & RUSSELL, LLP

By: 
Robert G. Weilacher, Reg. No. 20,531

Dated: March 4, 2010
Suite 3100, Promenade II
1230 Peachtree Street, N.E.
Atlanta, Georgia 30309-3592
Telephone: (404): 815-3593
Facsimile: (404): 685-6893